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de Ridder, G.J.

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Science and Scientism in Popular Science Writing
Jeroen de Ridder, VU University Amsterdam

Abstract

If one is to believe recent popular scientific accounts of developments in physics, biology, neuroscience, and cognitive science, most of the perennial philosophical questions have been wrested from the hands of philosophers by now, only to be resolved (or sometimes dissolved) by contemporary science. To mention but a few examples of issues that science has now allegedly dealt with: the origin and destiny of the universe, the origin of human life, the soul, free will, morality, and religion. My aim in this paper is threefold: (1) to show that these claims stem from the pervasive influence of a *scientistic epistemology* in popular science writing, (2) to argue that this influence is undesirable because it ultimately undermines not only the important role of popular science reporting in society but also the public's trust in science, and (3) to offer suggestions on how popular science writing can be improved.

1. Introduction

By increasing scientific literacy, popular science writing fulfills an important function in society. Science is a highly specialized and complex endeavor and its inner workings are virtually inaccessible to lay audiences. Nonetheless, scientific findings play a major role in society, by driving technological innovation, informing political decision-making and policy-building, and sometimes even by affecting people's self-image and worldview. And rightly so, because science is an impressive and highly successful effort to understand ourselves and the world we live in better. Popular science writing is one way in which the general public can stay informed about current scientific developments and thus form well-grounded opinions about broader developments in society that occur as a result of scientific developments.

It would very troubling, then, if best-selling popular science books were to be misleading, inaccurate, or otherwise flawed. Yet, this is indeed what is the case, or so I will argue in this paper. A lot of popular science writing is infested by what I take to be a fundamentally flawed epistemology, namely *scientism*, which — roughly — is the view that science is the only genuine source of knowledge about ourselves and the universe we live in. Moreover, scientism is typically assumed implicitly. One doesn't find any explicit articulation of it, let alone attempts to defend its truth or the reasonableness of assuming it. Hence, scientistic assumptions are easily overlooked, especially by lay audiences, most whom will not be sensitized to such matters as a result of, say, formal training in epistemology or philosophy of science.

I want to start by giving a quick impression of what this leads to. If you were to judge by the contents of recent popular scientific accounts of developments in physics, evolutionary biology, neuroscience, cognitive psychology, and evolutionary psychology, you would get the impression that many of the perennial big questions have now rightly been taken away from philosophers and other non-scientists. The advancement of science has finally given us definitive and empirically well-founded answers to them or, alternatively, it has shown that they can be dismissed as confused, misguided, or pointless.

Francis Crick, for instance, writes: “No longer need one spend time attempting... to endure the tedium of philosophers perpetually disagreeing with each other. Consciousness is now largely a scientific problem” (Crick 1996: 486). Frans de Waal concurs: “We seem to be reaching a point at which science can wrest morality from the hands of philosophers” (De Waal 1996: 218). Alex Rosenberg takes it to the max when he asserts that, in so far as the big questions are concerned: “Science has found the answers — some of them 400 years ago, others in the nineteenth century, and several others quite recently” (Rosenberg 2012: ix). Sam Harris sympathizes with this vision, although he is slightly more careful about the extent to which it has been realized already: “It seems inevitable, however, that science will gradually encompass life’s deepest questions” (2010: 7). Such claims are widespread. In an appendix, I’ve collected several more.

My goal in this paper is threefold: (1) to show the influence of scientism on popular science writing (sections 3, 4, and 5) and (2) to argue that this influence is undesirable (section 6) and (3) to suggest ways in which popular science writing can be improved (section 7). Before we get to this, however, I will use the next section to say more about what scientism is and why it can seem so appealing.

2. Scientism

To make my charge that popular science writers have fallen prey to a scientific epistemology more precise, we need to get clear on what scientism is. Like naturalism and physicalism, scientism is a term that has been given various meanings in both the popular (e.g., Kitcher 2012; Hughes 2012; Pinker 2013) and the philosophical literature (e.g., Sorell 1991; Stenmark 2001; Haack 2003; Rosenberg 2011; Ladyman et al. 2007; Peels forthcoming). A common thread running through them is of course an emphasis on the superiority and importance of (natural) science for human knowledge and understanding.

Massimo Pigliucci has recently given a fairly representative definition of scientism. Scientism, he writes, is:

A totalizing attitude that regards science as the ultimate standard and arbiter of all interesting questions; or alternatively that seeks to expand the

very definition and scope of science to encompass all aspects of human knowledge and understanding. (Pigliucci 2013: 144)

Although people might object to the term ‘totalizing’ as being too pejorative and quibble about whether scientism really aims to ‘expand’ the reach of science — after all, for an adherent of scientism all human knowledge presumably has always been within the reach of the sciences, even if people didn’t recognize this — this definition is a good start.

This definition can be refined by distinguishing between epistemological and ontological claims (cf. also Stenmark 2001; Peels forthcoming for this). Epistemological scientism holds that science is our only source of knowledge about ourselves and the world, while remaining non-committal on whether it is also the final arbiter of what exists. Ontological scientism maintains that science has the last word on what exists: Only those things exist that science — or perhaps a future, finalized science — recognizes or postulates. The two can be combined into a single position, but they can come apart too. One might subscribe to ontological scientism and hold that science has the final say on what exists, but that there are different viable paths to knowledge of the world, science being only of them (albeit perhaps a very important one) — thus rejecting ontological scientism. Alternatively, one might accept epistemological scientism and think that science is our only source of knowledge about the world, but also reject ontological scientism because one believes that science, and thus human knowledge, is limited as it does not have access to everything that exists or to all aspects of everything that exists.¹

For present purposes, epistemological scientism (ES) is most important. So let’s define it slightly more formally as follows:

(ES) Science is the only source of justified belief or knowledge about ourselves and the world.

I’ll add some further clarifications. First, ES doesn’t entail that we already know everything there is to know. It just says that *if* there is knowledge to be had about an issue, science is the only or the best way to acquire it. We should not rely on alleged sources of knowledge such as common sense, memory, testimony, pure reason, moral intuition, a priori philosophical argument, let alone revelation or a presumed divine sense. Second, ES allows for *provisional* reliance on other presumed sources of knowledge for

¹ Alexander Rosenberg — one of the few card-carrying proponents of scientism — defines scientism as follows:

The conviction that the methods of science are the only reliable ways to secure knowledge of anything; that science’s description of the world is correct in its fundamentals; and that when “complete,” what science tells us will not be surprisingly different from what it tells us today. (Rosenberg 2011: 6–7)

This definition thus combines epistemological and ontological scientism and adds the further clause that scientism takes science’s current picture of the world to be correct in its fundamentals.

as long as science hasn't spoken on certain issues. Belief in philosophical design arguments from biological diversity may have been justified before Darwin came along, but proper science — the theory of biological evolution, in this case — always trumps such arguments. Third, in claiming that science is our only source of knowledge, ES doesn't imply that we don't form beliefs through other sources. Clearly we do. The point is that scientifically supported beliefs always trump beliefs from other sources. Fourth, according to ES there are no domains of knowledge exempt from the reach of the sciences. Science isn't just concerned with physical reality and observable human behavior, but can — and should — also speak with authority on those matters that used to be solely within the purview of the humanities: e.g., the human mind, art, music, literature, free will, morality, rationality, and religion.

Why do people believe in epistemological scientism? And why can it seem to be a harmless background assumption that is easily overlooked by undiscerning readers? It might be the case that some scientists and philosophers who are inclined to scientism do have rigorous arguments for it, but they are the exception. Here, I want to focus on two quick and dirty arguments that typically aren't made explicit, but that are 'in the air' and that I think constitute much of the popular appeal of scientism.

First, there is a halo effect from science. There can be no doubt that science has made impressive progress over the course of the years. It has greatly increased our knowledge of ourselves and the world around us. Moreover, our whole lives are constantly affected — and often made better — by the applications of science: technology, medicine, and healthcare. The progress and results of science are so magnificent that it is easy to think that, where knowledge is concerned, science can do anything. This is where scientism comes in. The idea is that it is motivated by a simple induction from the success of science.

Second, when scientism is presented in certain ways, it can look like plain common sense. Here is how: If we want to acquire knowledge, we ought collect evidence systematically, reflect on our evidence and reason carefully from our evidence to a conclusion. Surely, *science* is our best and most successful way of gathering evidence and drawing conclusions from it. The scientific method guarantees that evidence is collected carefully and it ensures that the path from the evidence to the conclusion is safe. Therefore, if we want to acquire knowledge of anything whatsoever, we ought to do science.

These aren't very good arguments. On closer inspection, scientism suffers from very serious problems, as I'll point out in the next paragraph. But the problem is that considerations such as the above can seem fairly persuasive to lay audiences and even scientist without much training in philosophy of science or epistemology. As a result, neither science writers nor their readers typically pause to consider what scientism really implies and whether it is ultimately feasible.

In fact, however, there is a lot to be said against scientism. For starters, it's far from obvious how it can deal with mathematical, logical, and conceptual knowledge. An adherent of scientism would be hard-pressed to deny knowledge in these domains, but at the same time it is clear that knowledge in these areas does not result from empirical scientific inquiry. At the very least, then, scientism needs to make room for non-empirical (scientific?) inquiry. Furthermore, it's unclear what scientism can make of introspective knowledge (including knowledge of phenomenal consciousness) and knowledge of other people's minds. These, too, aren't clearly forms of scientific knowledge, yet they are undeniably very important and central to our lives. Everyday knowledge and common sense also constitute a challenge for scientism. It seems hard to deny that you possess knowledge about what you were wearing yesterday, about the way to your friend's office, about that beautiful lake cottage where you vacationed, about how your stomach feels, and many more such mundane things. But none of this is based on scientific inquiry. It even seems unlikely that scientific inquiry would lead to *superior* knowledge of these topics. Admittedly, it might give you more details or deeper explanations, but that wouldn't make you know *better* or *more securely* what you were wearing yesterday. This might seem insignificant, until one realizes that all science starts from just such everyday knowledge claims: about the readings on a computer screen, observations of behavior, survey reports, and so forth. Arguably, then, all science relies on such non-scientific knowledge, which would make scientism a nonstarter. Finally, scientism suffers from self-referential problems. Not being a scientific claim itself, it would seem scientism cannot be known by anyone. This raises the question of why anyone should assert or believe it in the first place. This paper, however, is not the place to delve deeper into these issues (but see Sorell 1991; Trigg 1993; Stenmark 2001; Haack 2007; Hutchinson 2011; Pigliucci 2013; Robinson 2015; and De Ridder et al. forthcoming for general discussion and development of these and other objections and replies).

3. Dismissing Philosophy

Given the above characterization of scientism, it is easy to see why those who sympathize with it would dismiss traditional philosophical discussions of the perennial questions. This follows straightforwardly from ES. Given that philosophical work on free will, morality, consciousness, etc. relies on conceptual analysis, common sense, a priori argument, thought experiments, intuitions, and combinations thereof, adherents of scientism will rule that it can give us no knowledge. Once scientific inquiry starts to investigate these topics, we should rely on its results as much as we can — provided, of course, that the science in question doesn't suffer from recognized methodological or substantive flaws. Even if the data is still limited and uncertain, we ought to start theorizing from *there* rather than continue to rely on inferior sources of information. The British geneticist Steve Jones once expressed the overall sentiment in an evocative metaphor: "For most wearers of white coats, philosophy is to science as pornography is to sex: it is cheaper, easier, and some people seem, bafflingly, to prefer it" (Jones 1997: 14).

Something like the above reasoning is indeed in the background of many popular science books, as I'll now show. One source of dismissiveness towards philosophy is that philosophers working on the big questions are ignorant of science and that (therefore) their work cannot be taken seriously. According to Stephen Hawking (2010: 5), "philosophers have not kept up with modern developments in science, particularly physics." The assumption must be that this is what they ought to have done, if they want to continue to talk about the ultimate origin of all that exists. It is thus taken for granted that scientific knowledge is our best bet when it comes to finding answers to the big questions.

Another frequently cited motivation to rely on science is philosophy's (alleged) lack of progress and (what may amount to the same thing) its failure to reach consensus. This was the point of Francis Crick's jibe about 'philosophers perpetually disagreeing'.² The contrast obviously is with science, which does make (certain kinds of) progress and does reach consensus more or less regularly. Again, the thought is that science is a superior source of answers to big questions.

It is also striking that many popular scientific treatments of origins, free will, morality, consciousness, and religion hardly engage any philosophical literature on these topics, not even to point out its perceived shortcomings or to argue against it. An unfortunate effect of this is that some science popularizers come up with woefully inadequate characterizations of key concepts and offer very crude arguments for and against positions that they're discussing. Examples of this include the neuroscientist P.R. Montague's description of free will as necessarily presupposing mind-body dualism: "Free will is the idea that we make choices and have thoughts independent of anything remotely resembling a physical process" Montague (2008: 584). Or Sam Harris's highly idiosyncratic requirement that in order to have free will, "you would need to be aware of all the factors that determine your thoughts and action, and you would need to have complete control over those factors" (Harris 2012: 13). It is easy to see how such misguided characterizations will lead to fallacious arguments against free will.

Given that philosophy has become a specialized discipline in which more is published than anyone can reasonably keep track of, it would be unfair to object that science writers haven't digested the latest issues of, say, the *Journal of Philosophy* and *Philosophical Review*. But that is not my point. Most of the relevant philosophical ideas and arguments about issues of origins, free will, morality, or consciousness are readily available from accessible introductory philosophy textbooks or free internet resources such as the [Stanford Encyclopedia of Philosophy](#) or the [Internet Encyclopedia of Philosophy](#). Even Wikipedia has fairly decent coverage of the basics in some areas of philosophy. The failure even to take notice of these materials suggests that some science popularizers

² A 2008 [report](#) on a meeting of biologists discussing the evolution of morality in *The Economist* explicitly makes this point: "Whence morality? That is a question which has troubled philosophers since their subject was invented. Two and a half millennia of debate have, however, failed to produce a satisfactory answer. So now it is time for someone else to have a go."

simply take it for granted that there is nothing to be learned from philosophical reflection on their topics.

4. Scientism in Action: Sam Harris

For all I've said so far, one might worry that scientism in popular science writing is a frivolous add-on or a commercial strategy, which only impacts forewords and blurbs. After all, claiming that one will subvert philosophical wisdom sounds a lot more attractive than saying that one will summarize some recent scientific developments which pretty much leave everyone's worldview intact. Scientism, however, runs deeper than this as I demonstrate in this and the next section.

I want to start with a look at Sam Harris's *The Moral Landscape*. I won't pretend to offer original criticisms of this book here. Various philosophers and other scholars have done an excellent job at reviewing the book critically and pointing out its problems.³ Nonetheless, Harris's book is instructive because it is so explicit and transparent in its adoption of a scientific outlook.

The project of *The Moral Landscape* is to argue that science can answer questions about right and wrong and that it is in fact the best way of finding answers to those questions. A first step in Harris's argument is that the fact/value distinction is a distinction without much of a difference. Questions about value translate into questions about facts. Harris develops different lines of support for this claim, but a central one involves fMRI studies that show that the same brain regions are active when people make factual judgements as when they make value judgements. In terms of underlying brain functions, then, "the division between facts and values does not make much sense" (121).

Let's pause briefly to consider this. The fact/value distinction is a logical or conceptual distinction between two 'families' of concepts. It serves to show that there is no logical route from 'is' to 'ought'. Philosophers debate its importance, but no one ever has ever suggested that the distinction must be implemented in brain regions and activity in order to possess philosophical oomph. So, for Harris to draw on fMRI results to discredit it is curious. It is like arguing against a distinction between, say, *modus ponens* and *ex consequentia* reasoning on the grounds that those who employ these forms of argument show the same brain activity. For the validity of logical and conceptual distinctions, brain activity is neither here nor there. Perhaps, then, this is a particularly infelicitous manifestation of scientism: rather than rely on philosophical arguments, Harris prefers to jump to conclusions from apparently irrelevant scientific data.

Back to Harris's project. The second step identifies the right with the promotion of the well-being of conscious beings: "A concern for well-being (defined as deeply and as

³ See, for instance, Kwame Anthony Appiah's and H. Allen Orr's reviews in the [New York Times](#) and the [New York Review of Books](#) respectively.

inclusively as possible) is the only intelligible basis for morality and values” (ibid.: 28). Well-being may be difficult to define exactly and our understanding of it is incomplete and evolving, but we do have a pretty firm grip on some of its key components, like physical and mental health, emotional flourishing, a supportive social environment, etc. The third step is the claim that human well-being is a completely natural affair. All of the facts about it are in principle open to scientific scrutiny. Questions about whether some action, policy, social arrangement contributes to the well-being of humans and other conscious creatures can be answered objectively by scientific means. Harris’s conclusion from this is that normative ethics is a scientific project: It consists in evaluating proposed actions, policies, institutions, practices, etc. in light of the amounts of well-being they promote, and choosing those courses of action that will increase general well-being.

The scientism shines through clearly here. By identifying the right with the promotion of the well-being of conscious beings and claiming that well-being is to be understood in completely natural terms, Harris effectively sidesteps substantial debates in normative ethics between consequentialism, deontology, and virtue ethics, opting for a version of consequentialism. In fairness, he does recognize that there are alternative accounts of rightness on offer, but surmises that they either ultimately boil down to a concern for well-being or else are nonsensical (ibid.: 32ff).

The obvious worry is that neither the identification of rightness with the promotion of well-being, nor the naturalness of well-being are things that follow from science. In fact, it’s hard to see how they could. Science isn’t in the business of making statements on moral rightness and wrongness and is also silent on the naturalness of well-being.

Harris’s scientific maneuver, then, boils down to this: He takes a firm philosophical stance without providing proper philosophical arguments for it and simply asserts that it follows logically from the results of science. In a telling note, he comments:

I did not arrive at my position on the relationship between human values and the rest of human knowledge by reading the work of moral philosophers; I came to it by considering the logical implications of our making continued progress in the sciences of the mind (ibid.: 213).

This is doubly curious. First, in its insistence that substantive moral views are among the ‘logical implications’ of the sciences of the mind — we just noted the problem with this.⁴ Second, the implicit admission that some sort of reasoning (or ‘considering’) is nonetheless necessary to draw out these implications is in tension with a wholesale dismissal of moral philosophy. For investigating what implications, if any, science has for morality is (part of) what moral philosophers have been working on for years. Properly doing this, then, would require serious engagement with moral philosophy.

⁴ In addition, it is odd that only the sciences of the *mind* should be taken to have implications for morality. One would expect that at least biology, too, should count for something.

5. Scientism in Action: Frans de Waal

Let's consider next what the well-known primatologist, Frans de Waal, has to say about evolution and morality. In a series of books (e.g., De Waal 1996, 2013; Macedo & Ober 2006), he has argued against what he dubs the 'veneer theory of morality': the view that moral behavior is but a fragile add-on to human nature, which is thoroughly amoral or immoral in and of itself. In opposition to the veneer theory, De Waal argues that human morality is a natural outgrowth of various kinds of social behavior in our evolutionary ancestors:

The fact that the human moral sense goes so far back in evolutionary history that other species show signs of it plants morality firmly near the center of our much-maligned nature. It is neither a recent innovation nor a thin layer that covers a beastly and selfish makeup (De Waal 1996: 218).

Based on a wealth of observations of the behavior of primates and other higher animals, he shows to what extent animals observe and respond to each other's feelings, care about each other's well-being, try to help each other, and enforce various schemes of reciprocity and fairness. What is perhaps even more surprising is that pro-social behavior extends not just to direct family and group members, but also to individuals outside the group and even across species-barriers. Behind all such behavior, De Waal proposes, are layers of neural and psychological mechanisms that enable and promote empathy. Cognitive evolution has built on top of this foundation to produce the more sophisticated forms of morality found in humans, which require ever greater expansions of the circle of empathy.

What makes De Waal interesting from our current perspective is that his tone is far less strident than that of writers like Harris or Rosenberg. We don't find the radical scientific line about science inevitably answering all of life's big questions. Nonetheless, as I want to show, there are more subtle scientific undertones in De Waal's work that deserve attention.

As you will recall from section 1, De Waal thinks that the time has come for science to 'wrest morality from the hands of philosophers'. Apparently, then, he believes science can provide answers to the questions that moral philosophers ask. But when we look at the issues De Waal ends up addressing, it turns out that they're rather different from the concerns of traditional moral philosophy. He details the origins of pro-social behavior in non-human and human animals: how it arose, its exact forms and scope, its possible evolutionary benefits, what neural and psychological mechanisms are responsible for it, etc. He also makes the plausible point that such pro-social tendencies are necessary for understanding human *moral* behavior and gestures at the idea that these tendencies partly explain the full spectrum of human morality. In his more recent work (De Waal 2013), he uses the same empirical findings to argue against 'top-down morality', which is the idea

that we derive specific moral prescripts from general moral principles, which are in turn derived from either pure reason or divine revelation.⁵ Instead, morality emerges from the bottom up, from deep in our evolutionary past.

All of this is rightly fascinating and one can only marvel at the sophisticated social lives of animals. But my concern is whether anything De Waal says supports the idea that science can take over moral philosophy. I don't think so. Here are two recent descriptions of the subject matter of ethics from representative introductory textbooks:

At the heart of ethics are two questions: (1) What should I do?, and (2) What sort of person should I be? (Shafer-Landau 2012: xi)

Normative ethics is the area of philosophy that, broadly speaking, is concerned with standards for right conduct and moral evaluation. Generally, such a theory will give an account of right action and try to give some idea of what makes it right. (Driver 2013: 2)

Ethics, then, is concerned with a particular sort of normative evaluation of human behavior and human beings. De Waal does not address these issues directly in any way. Evolutionary and neuroscientific explanations of pro-social behavior do not tell us what we ought to do or what sort of persons we ought to be. And even if empirical material and evolutionary theorizing ought to inform ethics, they still aren't the same thing. At the risk of belaboring the obvious: Showing that, say, humans, like apes, expect and enforce fairness doesn't all by itself entail that doing so is morally right and it certainly does not explain why it is right.

I should say that De Waal never commits the naturalistic fallacy in explicit form. Nonetheless, by advertising his work as having profound implications for our understanding of human morality, the suggestion looms large that we can easily get from how things *are* with pro-social behavior to how they *morally ought to be*. For instance, in a passage that attempts to relativize the importance of the is-ought distinction, he comments: "Human morality develops out of sensitivity to others and out of the realization that in order to reap the benefits of group life we need to compromise and be considerate of others" (De Waal 2013: 164). This conflates prudential oughts with moral ones.

De Waal's scientism, then, manifests itself as a bait-and-switch. He declares that science now has the means to answer traditional ethical questions, but instead changes the subject and elaborates on answers to a different set of questions. One never actually learns what

⁵ De Waal wrongly believes that this is something most philosophers subscribe to: "According to most philosophers, we reason ourselves toward moral truths. Even if they don't invoke God, they're still proposing a top-down process in which we formulate the principles and then impose them on human conduct" (ibid.: 17). Neither virtue ethicists nor moral intuitionists and particularists would accept this idea.

he thinks about answers to the original questions or whether he perhaps thinks that those questions are irrelevant or unanswerable.

6. Why It Matters

In the previous sections, we have witnessed a number of scientistic lapses: adopting a philosophical position but forgoing the intellectual duty to argue for it, claiming that it just follows from science; ignoring relevant philosophical concepts and discussions and making up definitions of concepts or arguing against straw-men; and announcing that a perennial question will be answered but instead discussing work that is of limited relevance to this. If we combed through other popular science books, the list could surely be extended: wild extrapolations from the scientific data, undue reliance on scientific results at the cost of ignoring common sense, presenting a simplistic picture that glosses over scientific uncertainties and/or philosophical complexities, etc. There's no point in doing that here, since the general pattern should be obvious by now. Several best-selling popular science writers implicitly rely on a scientistic epistemology, taking something like ES for granted.

Why should we care about this? Is there more to it than a petty complaint by philosophers who feel threatened because scientists invade their turf? I believe the influence of scientism on popular science writing is very important, for at least two reasons. First, scientific literacy among the general public is a great good. If you think that knowledge is valuable in itself, then learning about issues such as our origins, our place in the universe, and our powers and limitations is valuable for its own sake. If you don't think knowledge has intrinsic value, you can still agree that it has instrumental value. It contributes to people's intellectual autonomy, informs their decision-making and acting, and it will shape their self-image and worldview. The well-functioning of liberal democracy depends on its citizenry being autonomous and knowledgeable to a certain extent. This is why popular science writing has a potentially valuable role to play: It helps people acquire knowledge. If popular science writing is heavily influenced by a scientistic epistemology, this basically means that people receive one-sided, misleading, or flat-out false information about the state of contemporary science and its broader implications. Obviously, this detracts from, rather than contributes to scientific literacy.

Second, rampant scientism ultimately undermines the authority of science as our best source of information about those issues that do belong to its domain. This might happen in a number of ways. By prematurely presenting provisional scientific results and theories as if they have been established beyond doubt, scientistic treatments are exposed to the risk of regularly having to back-pedal on earlier claims. This can give the false impression that scientific ideas are more in flux than they in fact are and that there is hardly any progress in science — that it's all 'just theories'. Also, scientistic presentations of science tend to entangle scientific results with naturalistic or physicalistic world-views in which humans are 'nothing but' the atoms that make them up, their brains, their unconscious impulses, etc. and in which the universe is devoid of

meaning and purpose. Even if such seemingly bleak world-views should turn out to be ultimately correct, it surely is too early now to proclaim that we know so for sure. Since many people rightly find these world-views unattractive, they will become mistrustful of the science from which it allegedly follows. This, too, undermines science.

7. Popular Science Without Scientism?

It is an important question, then, is how popular science writing can do better. I will offer some general advice here that would already make a substantial difference. Admittedly, these points may seem somewhat trivial. By way of apology, I can only say that, as we saw, popular science writers frequently ignore them.

1. If you aren't going to write about the big questions, don't say you will.

No matter the commercial benefits, it is intellectually objectionable to write as if you're addressing perennial questions when you really aren't. A corollary of this advice is to avoid writing as if scientific developments on a topic have now made philosophical reflection on that topic superfluous, when these scientific developments don't really address the traditional philosophical questions. I take it that this hardly needs further explanation.

Of course, this advice doesn't amount to a ban on science writing that explores what scientific developments mean for free will, consciousness, morality, etc. Surely, scientific insights and discoveries having to do with these topics deserve to be brought under the public's attention. But in doing so it is important to be clear on (a) whether scientific findings bear directly on the big questions as traditionally conceived and (b) if they don't, how they might still be indirectly relevant to them. For instance, De Waal's findings are more naturally thought of as belonging to the project of describing morality and human moral behavior (or perhaps even more accurately: social behavior), rather than that of traditional normative ethics.

2. Distinguish between science and scientifically-inspired philosophy.

Above, we noted the scientistic tendencies to jump to philosophical conclusions from scientific evidence and to run together scientific and philosophical issues. This advice is the natural remedy against those tendencies. When you are explicit about what the scientific evidence is and which theories are well-confirmed on the one hand and how these scientific results might bear on philosophical ideas on the other, there can be no mistakes about where science stops and philosophy begins.

Related to this, authors should make it explicit how the argument from the scientific findings to philosophical claims is supposed to go. How are the relevant concepts defined in science and in philosophy? Is the argument a simple inductive generalization, an inference to the best explanation, or some combination of different arguments? What

additional premises are involved beyond the bare scientific data and inferences, if any? And what is the support for these premises?

I'm aware that I'm making this sound easier than it will be in practice. The distinction between science and philosophy isn't always sharp, and there is an ongoing debate about how much of philosophy could be or ought to be naturalized, i.e., replaced or at least significantly transformed by science. Even so, science writers could say where and how they go beyond the scientific data and why they think this is warranted. In this way, readers would at least be made sensitive to the potential problems that are involved in bringing science to bear on philosophical questions. For instance, science doesn't answer conceptual questions directly. So when a choice is made to define a concept in one way rather than another, readers can be made aware that this isn't itself a result of science. Similarly, science doesn't settle normative questions about the right and the good all by itself. So when it is suggested that, say, pro-social behavior is a good thing or that it is right to expand our 'circle of empathy' to non-human animals, it should become clear that this isn't entailed by science.

3. Get your concepts straight

When a work of popular science addresses a topic that philosophers have worked on for a long time already, it ought to be a minimal requirement for its author to adopt definitions of relevant concepts that are widely accepted in the philosophical community. And in those cases in which there is reason to reject those definitions, it ought to be explicated.

Although the niceties of lots of definitions of concepts are contested in philosophy, there is also common ground. The point of this advice isn't that every science writer ought to engage in extensive conceptual analysis first, but she should make sure that her definitions aren't in flagrant contradiction with commonly made background assumptions and shared components of different definitions. The definition of free will, for example, remains a matter of considerable controversy, but it is clear that it ought not to be defined in such a manner that it requires the truth of mind-body dualism or such that a free choice requires the complete absence of external influences (cf. the examples given above in section 3).

4. Mind that science has limits

It cannot just be assumed that science can speak authoritatively about any topic whatsoever, especially where traditional philosophical questions are concerned. For some topics, it really is an open question how much, if anything, science can say about them (e.g., the compatibility of free will and determinism) and in some cases it even seems implausible that it can (why there is something rather than nothing). If science writers want to write about those topics, they ought to consider whether other sources of evidence might be available — common sense, a priori reasoning, thought experiments, intuitions — and how they relate to scientific evidence in the neighborhood that is available. This might mean rendering some questions unto philosophy. After all,

philosophers have been using these sources of evidence for a long time in trying to answer perennial questions. At this point, popular science writing would have to turn into popular philosophy writing.

One might worry that following these pieces of advice would turn popular science books into an inaccessible philosophical treatises, which would presumably undermine their point. If popular science must be prefaced by a discussion of subtle philosophical distinctions and some finer points of epistemology, it wouldn't make for enjoyable reading. In other words, the worry is that it is inherent in the genre of popular science to run roughshod over the technicalities filling the pages of professional philosophical and other academic prose. These aren't the sort of things that lay audiences can — and must — be bothered with.

I am not convinced by this worry. I don't see why a philosophically sensitive treatment of some topic couldn't at the same time be accessible and lively. But instead of trying to establish this point by way of abstract argument, I'd rather point to tangible evidence for it. Although his position might be relatively close to a scientific perspective, Daniel Dennett has certainly been able to write about both science and philosophy in an extremely lively and accessible way (cf. his *Consciousness Explained* (1991) or *Freedom Evolves* (2003)). Furthermore, recent years have seen a number of other books which — at least in my opinion — do a wonderful job of presenting relevant scientific material while at the same time doing justice to philosophical insights and arguments. I'm thinking about Jim Holt's *Why Does the World Exist?* (2012) on the issue of ultimate origins, Rebecca Goldstein's *Plato at the Googleplex* (2014) on morality, and Alfred Mele's *Free: Why Science Hasn't Disproved Free Will* (2014) on free will. These books are clear testimony to the possibility — or rather the actuality — of popular science writing without scientism.

8. Conclusion

I've shown that a scientific epistemology pervades much contemporary popular science writing. We've looked in somewhat more detail at how this plays out in Sam Harris's and Frans de Waal's work on human morality, but similar points could be made about many other popular science books about origins, free will, rationality, and religion. This is a bad thing for a number of reasons. Not only does it undermine the potentially important role that science reporting has in modern society, it can also subvert the legitimate authority of science in those areas where we really ought to rely fully on scientific knowledge. Here lies a really important challenge, then, for science writers, scientists, and philosophers alike: to collaborate and produce works of popular science that are equally accessible, scientifically well-informed, and philosophically sensitive.

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Contact details: g.j.de.ridder@vu.nl

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Appendix

Scientistic sympathies are widespread throughout popular scientific literature. It is easy to find much more examples besides the quotes already given in the body of the text.

Physics / cosmology

- "Philosophy of science is about as useful to scientists as ornithology is to birds." (usually attributed to Richard Feynman and often quoted)
- "[While the question "Why is there something rather than nothing?"] is usually framed as a philosophical or religious question, it is first and foremost a question about the natural world, and so the appropriate place to try and resolve it, first and foremost, is with science." (Krauss 2012: xiii)

Consciousness

- “You, your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.” (Crick 1994: 3)

Morality

- “Scientists and humanists should consider together the possibility that the time has come for ethics to be removed temporarily from the hands of philosophers and biologized.” (Wilson 1975: 562)
- “We seem to be reaching a point at which science can wrest morality from the hands of philosophers. ... The occasional disagreements within this budding field are far outweighed by the shared belief that evolution needs to be part of any satisfactory explanation of morality.” (De Waal 1996: 218)

Free will

- Based on well-known experiments in neuroscience, Sam Harris claims: “Free will *is* an illusion. Our wills are simply not of our own making. Thoughts and intentions emerge from background causes of which we are unaware and over which we exert no conscious control. We do not have the freedom we think we have.” (Harris 2012: 5).
- “Our current knowledge of neurobiology makes it clear that there’s no such thing as absolute freedom. ... the only individuals who are still free to a degree (apart from their genetic limitations) are fetuses in the early stages of gestation.” (Swaab 2014: 327, 328)
- The title of a popular Dutch book on neuroscience is simply: *Free will does not exist: On who’s really in charge in the brain*. (Lamme 2010)

Religion

- “Science has advanced sufficiently to be able to make a definitive statement on the existence or nonexistence of a God having the attributes that are traditionally associated with the Judeo-Christian-Islamic God” (Stenger 2007: 11)
- “One of the important ... implications of the new cognitive science of religion is the possibility that we’ve been going about studying the God question completely wrong for a very long time. Perhaps the question of God’s existence is one that is more for psychologists than for philosophers, physicists, or even theologians” (Bering 2011: 8)